Second Declaration of David Cehrs, Ph.D. in Support of Plaintiffs' Reply Memorandum on Request for Relief Case No. C-F-00-6191 AWI DLB

I, David Cehrs, declare as follows:

1. I have reviewed the Declarations of Gary Smillie, Michael Tollefson, and portions of Defendants' opposition brief in which are referenced issues raised in my first declaration. The following is my response to those issues.

Rebuttal to Declaration of Gary Smillie:

- 2. Mr. Smillie agrees with me that the following are indeed true: "all infrastructure in the Valley alters [the river's] natural hydrologic system;" "roads...inherently obstruct the free flow of water;" "placing structural and paved impediments to the natural flow of the Merced River will inevitably affect the River's natural processes;" and "development of the floodplain of the Merced within Yosemite Valley poses problems for protection of hydrologic/geologic/ geomorphic ORVs." (Smillie, ¶ 3.) It is for these reasons that I concur with the efforts of the plaintiffs to protect the natural processes which are within and shape the internationally recognized site of natural wonder, Yosemite Valley and Yosemite National Park.
- 3. In paragraphs 3 and 7 Mr. Smillie indicates that Merced River channel migration rates are so slow as to be insignificant or non-existent compared to the Revised CMP planning horizon of 15 to 20 years. He states that any possible migration of the river will be mitigated by the management zoning and the River Protection Overlay for the Merced River. However, he has forgotten one critical hydrologic phenomenon of meandering rivers: channel avulsion, whereby a river will instantly change its channel location and abandon the old channel. According to the *Glossary of Geology* published by the American Geological Institute, "avulsion [is] (a) A sudden cutting off or separation of land by a flood or by an abrupt change in the course of a stream, as by a stream breaking through a meander or by a sudden change in current whereby the stream

deserts its old channel for a new one." Channel avulsion typically happens during high water events, floods or spring runoff, and could potentially happen as soon as this coming December or January with a winter flood. The probability of avulsion within a 15-20 year planning horizon is real and can not be discounted.

- 4. Mr. Smillie indicates that bank erosion and channel migration associated with meandering rivers, such as the Merced in Yosemite Valley, "would only occur, if ever, over the great span of geologic time." (Smillie, ¶ 7.) Yet research conducted in 1978 in Yosemite Valley found that Merced River channel migration rates were anthropogenically significant. Natural, lateral channel erosion rates in Yosemite Valley were up to 1.1 feet per year. (J. Milestone, *The Influence of Modern Man on the Stream System of Yosemite Valley*, 1978, pp.160-161.) A bank erosion study found the reach of the Merced below Sentinel Bridge in Yosemite Valley had experienced channel migration of up to 45 meters between 1919 and 1989, for an average migration rate of 2.1 feet per year. (Madej et al., *Analysis of Bank Erosion on the Merced River, Yosemite Valley*, 1991.)
- 5. Mr. Smillie states in Paragraph 3 that the NPS ". . . will restore 37 acres of riparian habitat along the river and remove five large buildings from the floodplain." If it were not for the January, 1997 flood, inundating this 37 acres and all the structures and infrastructure within it, the NPS would not be proposing this restoration and removal of structures. Realistically, the Merced River reclaimed its own floodplain during the 1997 event, inundating and destroying structures built on river territory. Yet the NPS is trying to claim this "benefit" for itself. The NPS does not seem to be cognizant of the fact that the river has infinitely more power than the

NPS does and the river will do whatever it wants, whenever it wants to any and all anthropogenic structures within Yosemite Valley.

- 6. In my first Declaration, paragraph 8, I noted that the NPS was using and calling the January, 1997 high water mark the 100-year flood line, even though the two are different, with the actual 100-year flood line being higher than the 1997 high water mark. The NPS now agrees with me on this. (Smillie, ¶5.) The distinction is important because floods greater than the 100-year event will inundate Yosemite Valley to elevations higher than that which occurred in January of 1997. These larger events can occur in any year but their probability of occurrence get smaller with increasing flood size. In addition, the floodplain below the 1997 high water line within Yosemite Valley will periodically be inundated with floodwaters of various volumes and durations. When high volume events occur the River will always use the floodplain to spread out and slow down the flow.
- 7. In his paragraph 6 Mr. Smillie objects to my indication that the floodplain is part of the river channel. However, during high water events the river moves out of its channel onto its floodplain, which is part of the river used during flood events. This principle is articulated well by Dr. Luna Leopold, in his book *Water, Rivers and Creeks* (University Science Books). Dr. Leopold was the preeminent hydrologist with the USGS during his working career.

Nearly all stream channels, whether large or small, will contain without overflow approximately that discharge that occurs about once a year. Higher flows, occurring on the average only once in 2 years, or once in 5 years or more, will be too large to be contained in the natural channel and will overflow the floodplain, that area adjacent to the stream or river. It is called floodplain because it is part of the river even though it is used only infrequently. In ordinary parlance, a flood is defined as water flowing out of the channel. Where humans use the floodplain they should expect to get wet at times, and flood damage is due to encroachment on a part of the river. (*Id.*, pp.64-65, emphasis added.)

- 8. Mr. Smillie agrees with me (paragraph 9) that impermeable surfaces will prohibit and impair water percolation into the meadows and wetlands of the Merced floodplain which will ultimately affect floodplain and riverine ecology. In non-flood years the hydrologic input to the upper floodplain/meadow/wetland is from snow melt and rainfall infiltration on the adjacent local area and groundwater underflow from the upgradient talus. Any impermeable surfaces within the Lodge area will then influence the local hydrology and ecology of the floodplain, and this local hydrology is independent of the rest of the Merced watershed.
- 9. In paragraph 10 Mr. Smillie agrees with me that construction within Yosemite Valley is responsible for Merced River channel widening. He disagrees, however, with my statement that structures increase floodplain roughness. My comments are based upon my professional experience plus the research of others on Yosemite Valley hydrology. Studies indicate that the health of the natural river systems within the park have dramatically declined over the years. (See e.g., Milestone, The Influence of Modern Man on the Stream System of Yosemite Valley, 1978 [Milestone]; Eagan, Modeling Floods in Yosemite Valley, California, 1998 [Eagan].) This is due to construction of structures, infrastructure, and erosion control measures (riprap, revetments, walls, etc.) within and into the rivers floodplains and channels. The cumulative impacts of this have been channel widening and an increase in channel and floodplain roughness (Eagan), which results in higher flood stages for a given volumetric flow. Thus, anthropogenic activities and lack of natural river processes within and on the floodplains are exacerbating the flooding of the park's rivers. Any new construction within and on the floodplain will only increase the problems.

10. In his paragraph 11 Mr. Smillie makes reference to Directors Order 77-2 claiming I made misstatements from it, specifically "NPS must avoid construction of facilities in a floodplain if alternative locations are available." In my paragraph 14 statement I relied on Executive Order 11988 and the NPS Floodplain Management Guidelines, Special Directive 93-4, Washington, D.C. My original reference to this NPS statement was derived from the *Merced Wild and Scenic River Comprehensive Management Plan/FEIS* of June, 2000 and the following paragraph is quoted from pages II-66-67 of that document:

Floodplain Management

Executive Order 11988 on floodplain management and the National Park Service Floodplain Management Guidelines (1993b) provide guidance for the protection of natural floodplain values and of life and property in the National Park System. The intent of the guidelines is to ensure public safety during and after a flood event, minimize property damage, and allow natural hydrologic processes to continue unimpeded to the extent possible. The National Park Service must avoid construction of facilities in a floodplain if alternative locations are available. Where no alternatives exist, policies may allow the construction of some facilities if risks to human life and property are studied and then minimized or mitigated through design. The Merced River Plan will also provide guidance on development within the floodplain through management zoning, the River Protection Overlay, and the Section 7 determination process. Where the Merced River Plan and the Floodplain Management Guidelines (1993b) or Executive Order 11988 provide conflicting direction, the most restrictive would apply.

11. Mr. Smillie agrees with me (paragraph 12) that "all roads interact with the local flow of water to some . . . degree . . ." Mr. Smillie believes the NPS can mitigate any natural phenomena with "sensitive" design and "insignificant area" impacts. However, 6.11 acres (515 feet by 515 feet) of paved surfaces within the 1997 high water mark at the Lodge project site is not insignificant. Irrespective of design, nature has the power to destroy such development in one flood event. Furthermore, as referenced in paragraph 8 above, this paved acreage also

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impedes the percolation of snowmelt and rainfall into the upper floodplain groundwater system to the detriment of the local ecology at the Lodge.

12. In his paragraphs 13 and 14 Mr. Smillie agrees with me that the impervious surfaces in the proposed Lodge project will double, but discounts this as being an insignificant or small area compared to the Lodge project site, the Yosemite Valley floor, or the Merced River watershed. He makes three points with regard to the planned 6.11 acres of impermeable surfaces within the Merced River floodplain at the Yosemite Lodge project site: 1) doubling the acreage of impervious surfaces is only a small percentage of the entire Yosemite Valley floor; 2) the effect of additional pavement in the Lodge area on the River will be minimal because it is only a small portion of the total; and 3) there will be no impact on hydrology because reduction of base flow due to impervious surfaces at the Lodge is "insignificantly small" as compared to the Merced River watershed. However, in my professional opinion the increase in paved surfaces will affect the immediate environment and ecosystem in and around the Lodge by reducing infiltration to the local groundwater aquifer which sustains the Lodge area ecosystem in the late summer months. This ecosystem includes the meadows and wetlands of the floodplain and the meander channels of the Merced River near the Lodge. The base flow from the aguifer will keep water in parts of the meander channels sustaining aquatic ecosystems not connected to the main Merced channel. The rest of the Merced watershed, no matter how large, can not provide this water. No matter that the impervious surfaces in discussion are small compared to the Valley or the total Lodge area; they are critical to the local Lodge area ecosystem and can not be discounted.

- 13. The notion that the increase in impervious areas are insignificant reminds me of the statement attributed to Senator Everett Dirksen "A billion here, a billion there, and pretty soon you're talking real money." We could translate this to: a few acres here, a few acres there and pretty soon you have paved the whole Valley. Taking the NPS "insignificantly small argument" to its logical conclusion: if the entire Yosemite Valley were paved it would be insignificant as it would only constitute one-half of one percent of the entire Yosemite National Park area and therefore would not matter. Each individual project within the Yosemite National Park will be argued as being insignificant in size and impact, yet the cumulative sizes and impacts must be considered. In fact every acre of increase in impervious surface does matter: it affects the local and Merced River ecosystem, it affects the local and watershed hydrology, and it occurs in a world heritage site of unsurpassed natural beauty that needs protection from human actions, including that of the NPS.
- 14. The NPS needs to make some critical decisions on visitor capacity for Yosemite National Park and specifically Yosemite Valley so that it can plan on how much infrastructure and what types of structures are necessary to accommodate this use. Without this planning the NPS will propose projects that impinge upon and affect the local (site specific) hydrology and ecology within the Valley as well as affect the Merced system Valley wide. Once these specific projects are built they will then be subject to natural flooding events within the Valley. These projects will not only be harmed by future floods but they will affect flood velocities, heights, and durations. This then sets up a feedback loop where increasing infrastructure and structures will only make subsequent flood events more damaging to those same structures and

infrastructure. Every incremental increase in anthropogenic activity is cumulative and that cumulative effect will have drastic consequences, most recently shown by the 1997 flood.

Rebuttal to Seventh Declaration of Michael J. Tollefson:

15. Mr. Tollefson attempts to use my personal public comment advocating for more camping opportunity, submitted for the 2000 CMP, as a basis to discredit my opinion.

(Tollefson Dec. ¶ 38, Ex. 12.) I believe this email was from myself and my wife, Anne Cehrs (the "we" in the sentence), responding as citizens to the request for scoping comments by the NPS. Subsequent to this comment Anne and I have changed our opinion, in that the NPS still needs more campsites within Yosemite National Park to replace the many campgrounds that the NPS has closed over the years (Tenaya Lake (2), Smoky Jack, White Wolf, Porcupine Flat, Yellowpine/Sentinel, Upper and Lower River). We now would like to see replacement campsites sited outside Yosemite Valley. Campground site areas outside the valley could include Big Meadow/Foresta, Chinquapin/Yosemite West, and Wawona. We would also like to see any subsequent construction of hard-sided lodging (scheduled for Camp Curry and Yosemite Lodge) to be moved out of Yosemite Valley to less sensitive environments. Our views on the need for camping opportunities do not conflict with my professional opinion regarding the impact of infrastructure on the Merced River hydrology

Rebuttal to Defendants' Memorandum Opposing Plaintiffs' Motion for Relief:

16. In their comments in the Defendants' Memorandum Opposing Plaintiffs' Motion for Relief, the defendants criticize my professional opinion on three general grounds: 1) I make broad categorical assertions (pages 27 and 29); 2) I ignore that impacts may be mitigated (pages

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27 and 28); and 3) I ignore that the impacts are so small as to be insignificant (pages 27, 28, and 29).

17. I make broad categorical assertions to underscore the point that natural phenomena and processes within Yosemite National Park, whether they be river flow and hydraulics or rock fall, have enormous forces and the power to destroy any man-made structures or infrastructure. These forces, floods or rock fall, can happen any given year for floods or at any time for rock fall. Importantly we can not predict when these phenomena will occur, or how large they will be. The actions of natural phenomena are unpredictable in both time and space. We do not know what any given flood will do: it may just deposit sediment, it may cut new channels and abandon old ones, it may erode some meanders and leave others untouched. The forces involved with large volumes of moving water and its included sediment are dramatic. Even if a flood does not erode or move things the water damage and the sediment deposited can cause major problems and hassles. Because of this, it is imperative that the NPS understand how the River moves and works through time and space. Installation of permanent facilities and infrastructure must be done in full recognition of this dynamic system. While mitigation may be intended to offset impacts from development, that very mitigation can be sacrificed to the River in any flood event. We saw this in 1997.

18. In my opinion, NPS planners and the planning process have been walking a fine line to site infrastructure and structures in the narrow zone above the 100-year high water line and below the rock fall shadow line within Yosemite Valley. They assume and plan accordingly that this narrow area between their two identified natural hazard zones is the "safe" zone in which to house visitors, park staff, and concession employees within Yosemite Valley. However, nature

does not know or care about these human drawn lines and will cross these lines. The rock fall damage to the new employee dorms at Camp Curry is the most recent example of this, where a structure below the rock fall shadow line was damaged by rock fall that theoretically should not go this far.

- 19. I am skeptical of NPS proposed mitigation. For example, the January, 1997 flood inundated both Upper and Lower River Campgrounds. The NPS said that they were abandoning these campgrounds and restoring them to native vegetation and habitat. Currently, these two campgrounds, nearly 10 years after the flood, show no signs of restoration. Instead they are the repositories of multiple piles of construction junk, including piles of broken concrete, asphalt, sand and gravel. A second example is shown by the new 2-story employee dorms built at Camp Curry. These were arguably constructed so that all environmental impacts were to be mitigated, yet these buildings were hit by rock fall after completion. In the case of the realignment of Northside Drive, Mr. Smillie believes that impacts will be remedied by "sensitive design location near the floodplain extremity," so that no significant impacts to the Merced River will result. (Smillie Dec. ¶12.) While he believes that this mitigation will work, he has no evidence to support that opinion.
- 20. The NPS and their declarants obviously believe that the impacts of the Lodge project, and other construction within Yosemite Valley, are so small as to be insignificant when compared to the size of the watershed, or the size of the park, or the size of the Valley. (*See e.g.*, Smillie Dec. ¶14.) However, they confuse the hydrology of the entire Merced River system with the hydrology of Yosemite Valley at the Lodge. The hydrology of the entire system results in annual river flow that volumetrically peaks in spring and early summer and declines into the

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winter. This annual, non-flood, Merced River flow does not recharge the groundwater aguifer of or provide surface flow across the floodplain at Yosemite Lodge. The ecosystem outside the Merced River channel is highly dependent upon the runoff and infiltration of snowmelt and precipitation on this portion of the Valley floor at the Lodge. No matter how large or small the entire Merced watershed, the 6.11 acres of proposed paved surfaces within the floodplain at the Lodge will impact the local floodplain and its ecology; this local floodplain can be measured in tens of acres and the paved surface is significant at this scale. It is the small scale upon which the environment exists and operates. To dismiss this as insignificant does a severe injustice to nature's operation of Yosemite Valley.

21. Because the paved surface is significant at this scale, it can have an impact on the base flow to the Merced River. The base flow to the Merced River is derived from soils and aguifers adjacent to the river. It is the combined input of all of these adjacent soils and aguifers that result in the flow of the river in the late summer and fall. The base flow from the Lodge portion of the floodplain is but a small portion of the entire watershed base flow, but it is significant in the local Lodge floodplain because it helps keep water in the otherwise dry meander loops of the Merced River at the Lodge. Ultimately, subsurface water will flow from the Lodge area floodplain to the Merced River, unless it is inhibited as a result of paved surfaces, structures, and infrastructure that prevents infiltration and diminishes groundwater volume. Again, it is significant at the local scale and can not be discounted. Additionally, defendants do not account for, nor discuss, the cumulative impacts, Valley wide, of increasing payed surfaces. structures, and infrastructure that will direct rainfall, prevent infiltration, and inhibit the free flow of surface and ground waters.

22. Finally, NPS has changed the meaning of my statements with each iteration of position. I will use one example. Below is a comparison, with emphasis added, of the Defendants' Memorandum Opposing Plaintiffs' Motion for Relief, page 28, lines 15-18, Smillie Declaration at paragraph 7, and my original Declaration at paragraph 11.

While Mr. Smillie concurs with the rather unremarkable proposition that "the Merced River essentially migrates over the entire extent of the Yosemite Valley floor," he does take issue with the implication of Dr. Cehrs's statement, namely, "that the NPS should remove all development from the Valley so that the river can freely meander." (Defendants' Memorandum Opposing Plaintiffs' Motion for Relief, page 28, lines 15-18.)

- 7. I do not disagree with Dr. Cehrs assertion in Paragraph 11 that, over time, the Merced River essentially migrates over the entire extent of the Yosemite Valley floor. The implication of this statement is that the NPS should remove all development from the Valley so that the river can freely meander. (Smillie Declaration, paragraph 7.)
- 11. Within the confines of Yosemite Valley the Merced River is a meandering river. The meandering Merced channel migrates laterally across the Valley floor and over time the channel occupies all locations within the Valley, talus slope to talus slope, and this action forms the floodplain. Channel migration is natural river behavior and is the result of river hydraulics within the channel curves. Water moves faster on the outside of the channel curve and slower on the inside of the channel curve. This results in erosion on the outside of curves and deposition on the inside of curves; the resulting deposit is called a point bar. The top of the point bar deposit is the floodplain. Most of the Yosemite Valley floor (river channel, floodplain, meadows, wetlands) is formed from the meandering river point bar deposits reworking past Valley floor glacial sediments with the additional input of new Sierran derived sediment; the remainder of the Valley floor is formed by alluvial fans from the tributary side streams entering the Valley, for example Yosemite Creek. Old Merced River locations can be located by their remnant oxbows observable on portions of the Yosemite Valley floor. The oxbows are abandoned channel meander curves. (Cehrs Declaration, paragraph 11.)

Contrary to the assertions made by NPS and its declarant, nowhere in paragraph 11, or elsewhere, do I mention removal of structures. My very simple point in paragraph 11 is that a natural phenomenon, in this case meandering stream channel hydraulics, has shaped the entire Valley floor and that in the future the River will again occupy and have occupied all parts of the Valley

1 floor. Mr. Smillie agrees with me on this. This means that all structures and infrastructure within 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

the Valley are at risk of this natural phenomenon. It may well be that the river will remove some of these structures of its own accord in the future, as it did in the January, 1997 flood with the cabins and the five larger buildings at the Lodge. I have never taken the position that the NPS should remove all development from the Valley. My professional opinion is simply that the NPS must account for the natural processes which can adversely affect development within the Valley, and which may also be adversely impacted by development. Therefore, it is imperative that NPS development planning first determine user capacity to understand the type and level of use that is appropriate for the River, rather than installing development with no determination of the level of use necessary to protect Merced River values.

Pursuant to 28 U.S.C. § 1746 and under the laws of the United States, I declare under penalty of perjury that the foregoing is true and correct. Executed this 3rd day of October, 2006 in Sanger, California.

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/s/ David Cehrs

David Cehrs, Ph.D

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Second Declaration of David Cehrs, Ph.D. in Support of Plaintiffs' Reply Memorandum on Request for Relief